Virtual Guidance of Abdominal Trauma Using Augmented Reality

Completed Technology Project (2012 - 2013)

Project Introduction

Ultrasound is the only medical imaging modality on the International Space Station due to its size, power requirements and versatility in medical imaging. Unfortunately, ultrasound is a very operator dependent procedure and astronauts do not have time to train sufficiently before flight. Virtual Guidance, a type of just-in-time training, is a method used to facilitate autonomous operation of medical ultrasound by untrained astronauts with a real-time audio/video tutorial when distances from Earth render remote guidance impractical. Virtual Guidance, viewed through video glasses while actually scanning, has demonstrated successful imaging of the eye and carotid artery. This project improves on earlier successes by incorporating Augmented Reality in the form of 3D anatomy illustrations, thus improving the astronaut's situational awareness for the assessment of abdominal trauma. Untrained ultrasound operators will be recruited in the future to perform Focused Assessment with Sonography in Trauma (FAST) exams using only the Virtual Guidance audio/video tutorial. The quality of the resulting Images will be evaluated by an external expert.

On the International Space Station, astronauts have to be guided through ultrasound studies by experts on the ground. This method is called remote guidance, and has been very successful with communication time delays of 2 seconds or less. On missions further from earth, remote guidance will not be possible. Virtual Guidance streams an audio video tutorial to the astronaut through video glasses actually while they are performing the ultrasound study. The tutorial includes step by step instructions in patient positioning, equipment use, how to hold the probe, scanning protocols and required images. For each required image, there is a photograph of the probe location, a representative ultrasound image from the site and audio instructions in how to achieve the view. In addition, there is a section for each required view that covers what can go wrong. This includes images from incorrect locations and how to improve the image to achieve the required results. Virtual guidance has demonstrated successful imaging of the eye and carotid artery. This project builds upon previous successes with Virtual Guidance by incorporating Augmented Reality, in the form of a 3-dimensional anatomical image, improving the astronaut's situational awareness. Untrained ultrasound operators will be recruited in the future to perform Focused Assessment with Sonography in Trauma (FAST) exams using only the Virtual Guidance audio/video tutorial. The quality of the resulting Images will be evaluated by an external expert.

Anticipated Benefits

Currently, there is no method to guide astronauts on exploration class missions through an ultrasound study and there is unlikely to be time to sufficiently train to use ultrasound before flight. Virtual Guidance will address that need. Ultrasound is only medical imaging equipment on the International

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

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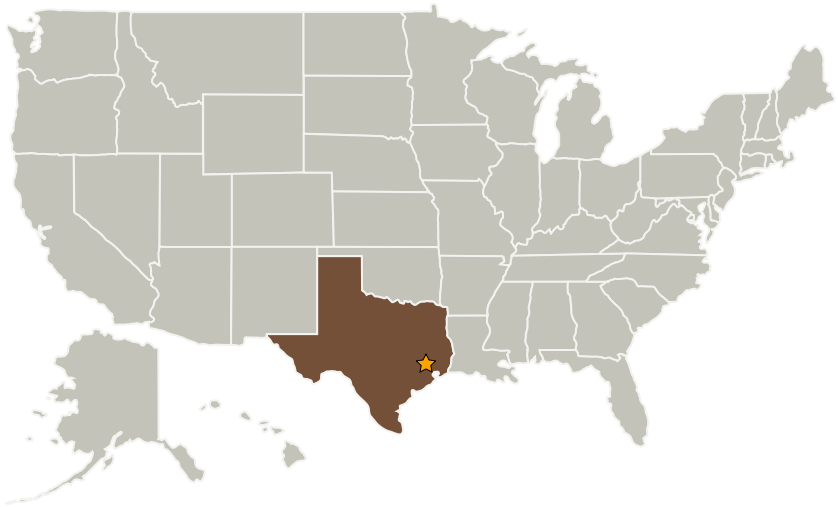
Space Station and given the size and power requirement of other modalities, ultrasound is likely to be the only medical imaging equipement on future missions. The product of this activity was to develop a system that allows ultrasound operators autonomous acquisition of a FAST ultrasound exam. The resulting product will not require significant alterations to be flight-ready.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Wyle Integrated Science and Engineering Group	Supporting Organization	Industry	

Primary U.S. Work Locations
Texas

Project Management

Program Director:
Michael R Lapointe

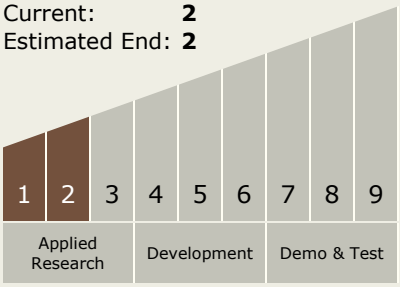
Program Manager:
Carlos H Westhelle

Project Manager:
Steven H Platts

Principal Investigator:
Steven H Platts

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.1 Medical Diagnosis and Prognosis